OIPE JC68
OCT 14 2004
PATENT & TRADEMARK OFFICE

IFW

Docket No.: 4468-012A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :

SHIMAWAKI, KAZUHIRO : Confirmation No. 1915

U.S. Patent Application No. 10/806,257 : Group Art Unit: 2184

Filed: March 23, 2004 :

For: RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM

PETITION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Petition is in response to the Notice of Omitted Items in a Non-provisional Application dated September 17, 2004. On March 23, 2004 Applicant filed a Request form for application under 37 CFR 1.53 (b), together with a complete copy of the prior Application No. 09/712,844 and Declaration as filed on November 15, 2000, Preliminary Amendment and a credit card form in the amount of $856.00 (a copy of a stamped post card receipt is enclosed).

Based on the above, Applicant believes that no fee is required.

However, if necessary, please charge any deficiencies in the enclosed fees to Deposit Account 07-1337 and direct any inquiries in connection with this application directly to the undersigned.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

Kenneth M. Berner

Kenneth M. Berner
Registration No. 37,093

Customer Number: 22429
1700 Diagonal Road, Suite 300
Alexandria, Virginia 22314
(703) 684-1111 KMB/iyr
(703) 518-5499 Facsimile
Date: October 14, 2004

OIPE JC68 OCT 14 2004 PATENT & TRADEMARK OFFICE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/806,257	03/23/2004	Kazuhiro Shimawaki	4468-012A

CONFIRMATION NO. 1915

LOWE HAUPTMAN GILMAN & BERNER, LLP
Suite 300
1700 Diagonal Road
Alexandria, VA 22314

FORMALITIES LETTER

OC000000013829518

Date Mailed: 09/17/2004

NOTICE OF OMITTED ITEM(S) IN A NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

A filing date has been accorded to the above-identified nonprovisional application papers; however, the following item(s) appear to have been omitted from the application:

- Page(s) **15-27** of the specification (description and claims).

I. Should applicant contend that the above-noted omitted item(s) was in fact deposited in the U.S. Patent and Trademark Office (USPTO) with the nonprovisional application papers, a copy of this Notice and a petition (and $130.00 petition fee *(37 CFR 1.17(h))*) with evidence of such deposit **must** be filed within **TWO MONTHS** of the date of this Notice. The petition fee will be refunded if is determined that the item(s) was received by the USPTO.

II. Should applicant desire to supply the omitted item(s) and accept the date that such omitted item(s) was filed in the USPTO as the filing date of the above-identified application, a copy of this Notice, the omitted item(s) (with a supplemental oath or declaration in compliance with 37 CFR 1.63 and 1.64 referring to such items), and a petition under 37 CFR 1.182 (with the $130.00 petition fee *(37 CFR 1.17(h))* requesting the later filing date **must** be filed within **TWO MONTHS** of the date of this Notice.

Applicant is advised that generally the filing fee required for an application is the filing fee in effect on the filing date accorded the application and that payment of the requisite basic filing fee on a date later than the filing date of the application requires payment of a surcharge (37 CFR 1.16(e)). To avoid processing delays and payment of a surcharge, applicant should submit any balance due for the requisite filing fee based on the later filing date being requested when submitting the omitted items(s) and the petition (and petition fee) requesting the later filing date.

III. The failure to file a petition (and petition fee) under the above options (I) or (II) within **TWO MONTHS** of the date of this Notice (37 CFR 1.181(f)) will be treated as a constructive acceptance by the applicant of the application as deposited in the USPTO. **THIS TWO MONTH PERIOD IS NOT EXTENDABLE UNDER 37 CFR 1.136(a) or (b)**. In the absence of a timely filed petition in reply to this Notice, the application will maintain a filing date as of the date of deposit of the application papers in the USPTO, and original application papers (*i.e.*, the original disclosure of the invention) will include only those application papers present in the USPTO on the date of deposit.

In the event that applicant elects not to take action pursuant to options (I) or (II) above (thereby constructively electing option (III)), amendment of the specification to renumber the pages consecutively and cancel incomplete sentences caused by any omitted page(s), and/or amendment of the specification to cancel all references to any omitted drawing(s), relabel the drawing figures to be numbered consecutively (if necessary), and correct the

references in the specification to the drawing figures to correspond with any relabeled drawing figures, is required. A copy of the drawing figures showing the proposed changes in red ink should accompany with any drawing changes. Such amendment and/or correction to the drawing figures, if necessary, should be by way of preliminary amendment submitted prior to the first Office action to avoid delays in the prosecution of the application.

Replies should be mailed to: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 1 - ATTORNEY/APPLICANT COPY

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OCT 14 2004
PATENT & TRADEMARK OFFICE

L(E HAUPTMAN GILMAN & BERNER LLP
1700 Diagonal Road, Suite 300, Alexandria, VA 22314

Early Serial Number Requested

NEW PATENT APPLICATION

Docket No.: 4468-012A

Enclosed for filing herewith is a

☒ Utility Application ☐ Design Application ☐ Provisional Application
☐ National Stage Processing of Int'l Application. No. Filed:

Of (INV.): Kazuhiro Shimauchi

For (Title): Reception data synchronizing apparatus and method, and recording medium with recorded reception data synchronizing program

The PTO stamp hereon acknowledge receipt of:

☒ Specification, Claims & Abstract (pages ___) (No. Claims ___) ☒ Drawings (sheets 8) ☒ Formal
☐ PCT National Stage Transmittal Letter (PTO Form 1390), with: ☐ International Publication No.
☐ Translation ☐ Amendment (Article 19), ☐ Translation ☐ Amendment (Article 34) ☐ Translation
☐ Request for filing ☐ Continuation ☒ Divisional (37 CFR 1.53b)
☒ Copy of Prior Application & Declaration SN: 09/812,844 Filed:
☒ Declaration/Power of Atty. ☒ Claim to Priority
☒ Assignment with recordation form cover sheet ☐ Certified Copy of Priority Document(s)
☐ Info. Disclosure Statement, PTO 1449 & references ☒ Preliminary Amendment
☐ Statement Regarding Sequence Listing under 37 C.F.R. § 1.821
☐ Check No. ☒ Credit Card Payment Form No. 4442 Amount: $ 856
☐ Others:

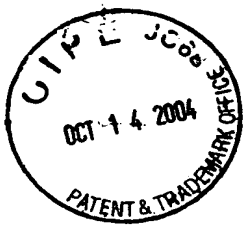
22387 U.S. PTO
10/806257

032304

Filed By/For: KMB/jyr Date: 03/23/04

REQUEST FOR FILING FOR APPLICATION UNDER 37 CFR 1.53(b)

DOCKET NUMBER: **4468-012A**
Prior Application: **09/712,844**
Art Unit: **2634**
Examiner: **JASON M. PERILLA**



Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a Request for filing a Divisional application under 37 CFR 1.53(b) of pending prior U.S. Patent Application No.09/712,844, filed on November 15, 2000, entitled **RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM**, by the following named inventor (s) **Kazuhiro SHIMAWAKI**

1. ☒ I hereby state that the enclosed copy of this prior application is a true copy of the above-identified prior application.

2. Oath or Declaration
 a. ☐ Newly executed (original or copy)
 b. ☒ Copy from a prior application (37 CFR 1.63(d))
 i. ☐ Deletion of inventor(s)
 Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

3. ☒ Incorporation By Reference (useable if Box 2b is checked)
 The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 2b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

4. ☒ Preliminary Amendment is enclosed.

5. ☐ An Information Disclosure Statement and PTO1449 Form are submitted herewith.

6. ☒ Cancel claims 1, 4-6, 9-11, 14-16, 19-20.

7a. The filing fee is calculated on the basis of the claims existing in the prior application as amended at 4 and 6 above:

	NO. OF CLAIMS		EXTRA CLAIMS	RATE	FEE
Total Claims	8	MINUS 20	0	x $18 =	$0.00
Independent Claims	4	MINUS 3	1	x $86 =	86.00
				Basic Application Fee	$770.00
				If multiple dependent claims are presented, add $290.00	0.00
				Total Application Fee	$856.00
				Subtract 1/2 if small entity	
				TOTAL APPLICATION FEE DUE	$856.00

☒ CREDIT CARD AUTH FORM ☐ CHECK ☐ CHARGED TO DEPOSIT ACCOUNT NO. 07-1337

7b. [] Applicant is entitled to small entity status under 37 CFR 1.9 and 37 CFR 1.27.

8. [X] The Commissioner is hereby authorized to charge fees under 37 CFR 1.16 and 1.17 which may be required, including any extension of time fees to maintain the pendency of the parent application Serial No. 09/712,844 or credit any overpayment to Deposit Account No. 07-1337.

9. [X] Amend the specification by inserting before the first line the sentence:
This application is a Divisional Application Under Rule 53 (b) of Application Serial No. 09/712,844 filed on November 15, 2000 which in turn is a Continuation of Japanese Patent Application No. 323624/1999 filed on November 15, 1999, and priority is hereby claimed under 35 USC 119 based on these applications.

10. [X] Priority of U. S. Application No. 09/712,844 filed on November 15, 2000 is claimed under 35 USC 119. The certified priority document(s) of Japanese Application No. 323624/1999 with priority date of 15/11/1999 were filed in Serial No. 09/712,844 on November 15, 2000 in the U.S. Patent and Trademark Office.

11. [X] The prior application is assigned of record to **ADVANTEST CORPORATION.**

12. [X] The power of attorney in the prior application is to:
LOWE HAUPTMAN GILMAN & BERNER, LLP formerly

LOWE HAUPTMAN GOPSTEIN GILMAN & BERNER, LLP

13. [X] Also enclosed:

8 pages of drawings.

14. [] A petition, fee and response has been filed to extend the term in the pending prior application until

Address all future communications to: (May only be completed by applicant, or attorney or agent of record)

LOWE HAUPTMAN GILMAN & BERNER, LLP
1700 Diagonal Road, Suite 300
Alexandria, Virginia 22314

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

Kenneth M. Berner

Kenneth M. Berner
Registration No. 37,093

Date: March 23, 2004
USPTO Customer No. 22429
1700 Diagonal Road, Suite 310
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(703) 518-5499 Facsimile

OIPE JC68 OCT 14 2004 PATENT & TRADEMARK OFFICE

Docket No.: 4468-012A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
	:	Confirmation No. 9271
Kazuhiro SHIMAWAKI	:	
	:	
Divisional Application of U.S. Patent Application No. 09/712,844	:	Group Art Unit: 2634
	:	
Filed: *herewith*	:	Examiner: Jason M. Perilla

For: RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Preliminary to examination of the above-referenced Divisional Application Under Rule 53 (b) of Application Serial No. 09/712,844 filed on November 15, 2000, which in turn is a Continuation of Japanese Patent Application No. 323624/1999 filed on November 15, 1999, and priority is hereby claimed under 35 USC 119 based on this application, please amend the application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 7 of this paper.

Amendments to the Specification:

Please add the following paragraph after the title of the current Invention beginning on page 1 as follows:

This application is a Divisional Application Under Rule 53 (b) of Application Serial No. 09/712,844 filed on November 15, 2000, which in turn is a Continuation of Japanese Patent Application No. 323624/1999 filed on November 15, 1999, and priority is hereby claimed under 35 USC 119 based on this application.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (canceled)

2. (original) A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording means for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision means for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating means operative, when the collation and synchronism decision means gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording means, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

3. (original): A reception data synchronizing apparatus according to claim 2, wherein the timing generating means transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording means records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

4-6 (canceled).

7 (original): A reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data and; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

8. (original): A reception data synchronizing method according to claim 7, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

9-11 (canceled).

12. (original) A computer- readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

13. (original): A computer-readable medium according to claim 12, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

14-16 (canceled).

17. (original): A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording device that records a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording device, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

18 (original): A reception data synchronizing apparatus according to claim 2, wherein the timing generating device transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording device records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

19-20 (canceled).

REMARKS:

This Divisional Application is responsive to the Restriction Requirement dated January 28, 2004.

The above-referenced application is amended to Application Serial No. 09/712,844 filed on November 15, 2000, which in turn is a Continuation of Japanese Patent Application No. 323624/1999 filed on November 15, 1999.

The Formal Drawings for the Divisional Application are enclosed herewith.

Applicant hereby elects claims 2, 3, 7, 8, 12, 13, 17 and 18 which are directed to species of configuration in Figures 4-6 for examination in this case. Claims 1, 4, 5, 6, 9-11, 14-16, 19-20 have been canceled in this application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

Kenneth M. Berner

Kenneth M. Berner
Registration No. 37,093

Customer Number: 22429
1700 Diagonal Road, Suite 310
Alexandria, Virginia 22314
(703) 684-1111 KMB/iyr
Facsimile: (703) 518-5499
Date: March 11, 2004

OIPE JC64
OCT 14 2004
PATENT & TRADEMARK OFFICE

Docket No.:

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter claimed and for which a patent is sought on the invention entitled RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM,

the specification of which

[X] is attached hereto [] was filed on _____ as Application Serial No. _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):			Priority Claimed	
Number	Country	Day/Month/Year filed	Yes	No
323624/1999	Japan	15/11/1999		

I hereby claim the benefit under 35 USC §119(e) of any United States provisional application(s) listed below.

Prior Provisional Application(s):

Application Number	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or Section 365(c) of any PCT international application designating the Untied States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application :

Prior U. S. Application(s) :

Serial No.	Filing Date	Status : Patented, Pending, Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney and/or agent(s): Allan M. Lowe, Reg. No. 19 ; Benjamin J. Hauptman, Reg. No. 29,310; Israel Gopstein, Reg. No. 27,333; Kenneth M. Berner, Reg. No. 37,093; Michael G. Gilman, Reg. No.19,114; Albert J. Fasulo II, Reg. No. 43,607; and Randy Noranbrock, Reg. No. 42,940, all of

LOWE HAUPTMAN GOPSTEIN GILMAN & BERNER, LLP
1700 Diagonal Road, Suite 310
Alexandria, Virginia 22314

with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and all future correspondence should be addressed to them.

Full name of sole or first inventor : Kazuhiro SHIMAWAKI

Inventor's signature : Kazuhiro Shimawaki Date : 2000, 11, 6

Residence : Saitama-ken, Japan

Citizenship : Japan

Post Office Address : c/o ADVANTEST Corporation 1-32-1 Asahi-cho, Nerima-ku, Tokyo, 179-0071 Japan

Full name of second joint inventor :

Inventor's signature : Date :

Residence :

Citizenship :

Post Office Address :

Full name of third joint inventor :

Inventor's signature : Date :

Residence :

Citizenship :

Post Office Address :

Full name of fourth joint inventor :

Inventor's signature : Date :

Residence :

Citizenship :

Post Office Address :

Full name of fourth joint inventor :

Inventor's signature : Date :

Residence :

Citizenship :

Post Office Address :

ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AN[illegible]RADEMARKS
Washington, D.C. [illegible]0231

FEBRUARY 05, 2001

PTAS

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LOWE HAUPTMAN GILMAN & BERNER
KENNETH M. BERNER
1700 DIAGONAL ROAD
SUITE 310
ALEXANDRIA, VA 22314

FEB 7 2001

Lowe, Hauptman, Gopstein & Berner

UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT DIVISION OF THE U.S. PATENT AND TRADEMARK OFFICE. A COMPLETE MICROFILM COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW.

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE. THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM. IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE, YOU MAY CONTACT THE EMPLOYEE WHOSE NAME APPEARS ON THIS NOTICE AT 703-308-9723. PLEASE SEND REQUEST FOR CORRECTION TO: U.S. PATENT AND TRADEMARK OFFICE, ASSIGNMENT DIVISION, BOX ASSIGNMENTS, CG-4, 1213 JEFFERSON DAVIS HWY, SUITE 320, WASHINGTON, D.C. 20231.

RECORDATION DATE: 11/15/2000

REEL/FRAME: 011287/0888
NUMBER OF PAGES: 2

BRIEF: ASSIGNMENT OF ASSIGNOR''S INTEREST (SEE DOCUMENT FOR DETAILS).

ASSIGNOR:
SHIMAWAKI, KAZUHIRO

DOC DATE: 11/06/2000

ASSIGNEE:
ADVANTEST CORPORATION
1-32-1 ASAHI-CHO
NERIMA-KU
TOKYO, JAPAN 179-0071

SERIAL NUMBER: 09712844
PATENT NUMBER:

FILING DATE:
ISSUE DATE:

PAULA MCCRAY, EXAMINER
ASSIGNMENT DIVISION
OFFICE OF PUBLIC RECORDS

FORM PTO-1596 11/15/00
1-31-92
DOCKET NO.: 4468-012

101538890

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

To the Honorable Commissioner of Patents and Trademarks: Please record the attached original documents or copy thereto:

1. Name of conveying party(ies):

Kazuhiro SHIMAWAKI

Additional name(s) of conveying party(ies) attached?

2. Name and address of receiving party(ies):

Name: **Advantest Corporation**

Internal Address:

Street Address: **1-32-1 Asahi-Cho, Nerima-ku,**

City: **Tokyo** State or Area:
Zip/Postal Code: **179-0071** Country: **Japan**

Additional name(s) & address(es) attached?

3. Nature of conveyance:

X Assignment __ Merger

__ Security Agreement __ Change of Name

__ Other

Execution Date: **November 6, 2000**

4. Application number(s) or patent number(s): 09/712844

If the document is being filed together with a new application, the execution date of the application is: **November 15, 2000**

A. Patent Application No(s).

B. Patent No(s).

Additional numbers attached?

5. Name and address of party to whom correspondence concerning document should be mailed:

Name: **LOWE HAUPTMAN GILMAN & BERNER**

Internal Address:

Street Address: **1700 Diagonal Road, Suite 310**
City: Alexandria State: **VA** ZIP: **22314**

6. Total number of applications and patents involved: **1**

7. Total fee (37 CFR 3.41)

8. Deposit account number: **07-1337**

DO NOT USE THIS SPACE

9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Kenneth M. Berner
Reg. No. 37,093

Kenneth M. Berner
Signature

November 15, 2000
Date

Total number of pages comprising cover sheet: 2

CMB No. 0851-0011 (exp. 4/94)

11/17/2000 JBALINAN 00000122 09712844
3 FC:581 40.00 OP

OIPE JC893 U.S. PTO 09/712844 11/15/00

OCT 14 2004 PATENT & TRADEMARK OFFICE

ASSIGNMENT

In consideration of the premises and other good and valuable consideration in hand paid, the receipt and sufficiency of which is hereby acknowledged, the undersigned,

(1) Kazuhiro SHIMAWAKI
(2) _____
(3) _____
(4) _____
(5) _____
(6) _____

who have made a certain new and useful invention, hereby sell, assign and transfer unto

ADVANTEST Corporation

its successors and assigns (hereinafter designated "ASSIGNEE") the entire right, title and interest for the United States of America as defined in 35 U.S.C. 100 in the invention entitled

RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM

(a) for which an application for United States Letters Patent was filed on , and identified by United States Serial No. ; or

(b) for which an application for United States Letters Patent was executed on ,

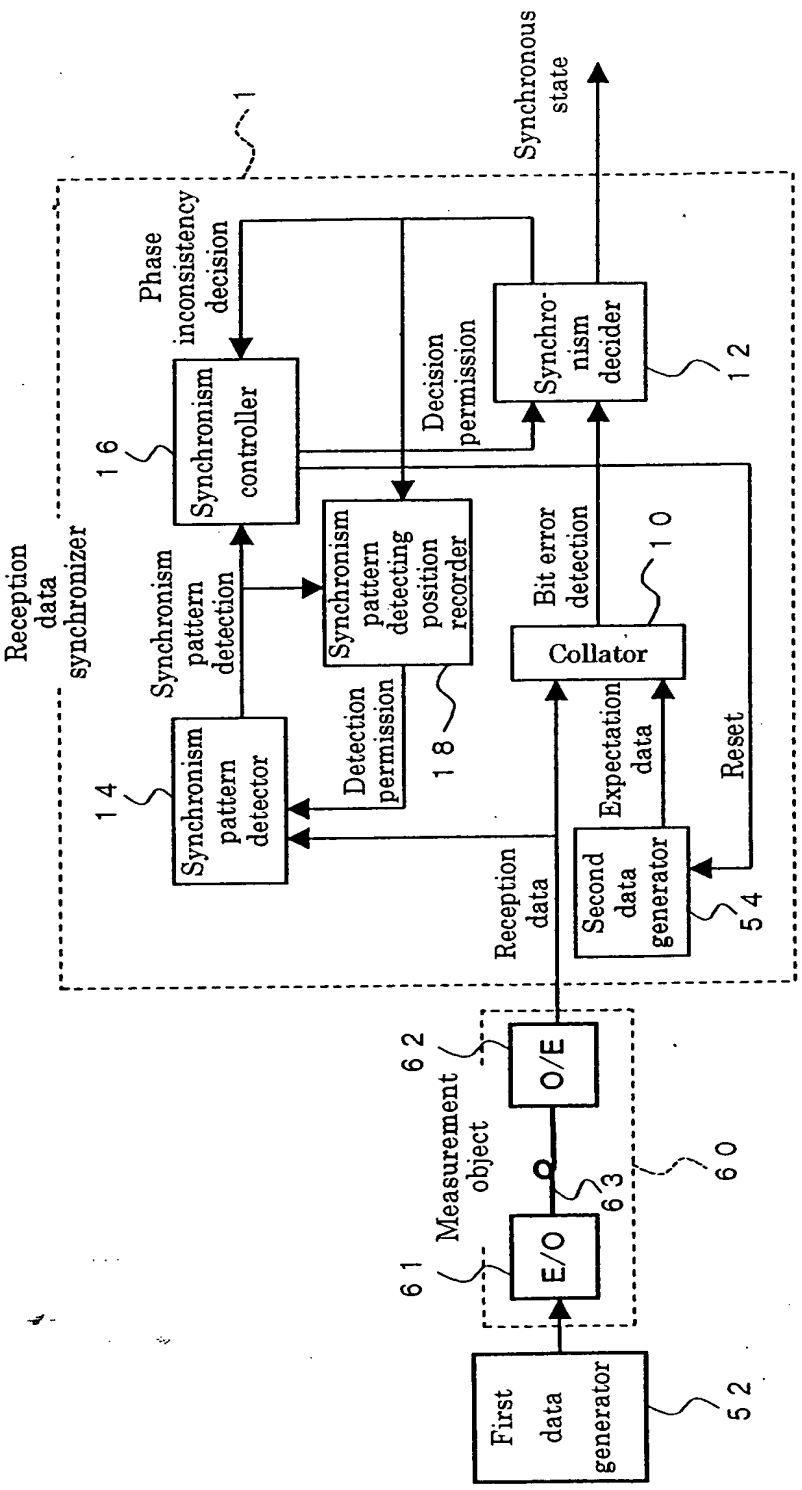
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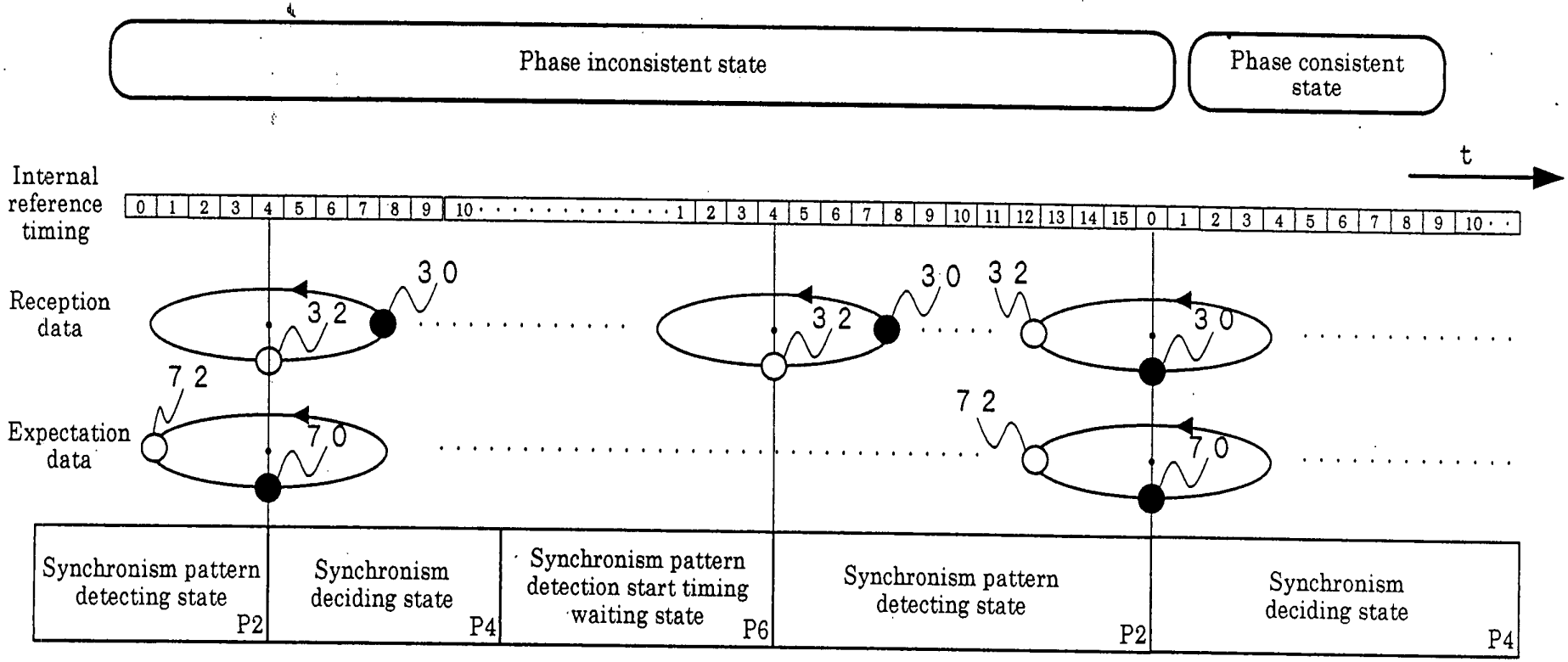
SIGNED on the dates indicated aside our signatures:

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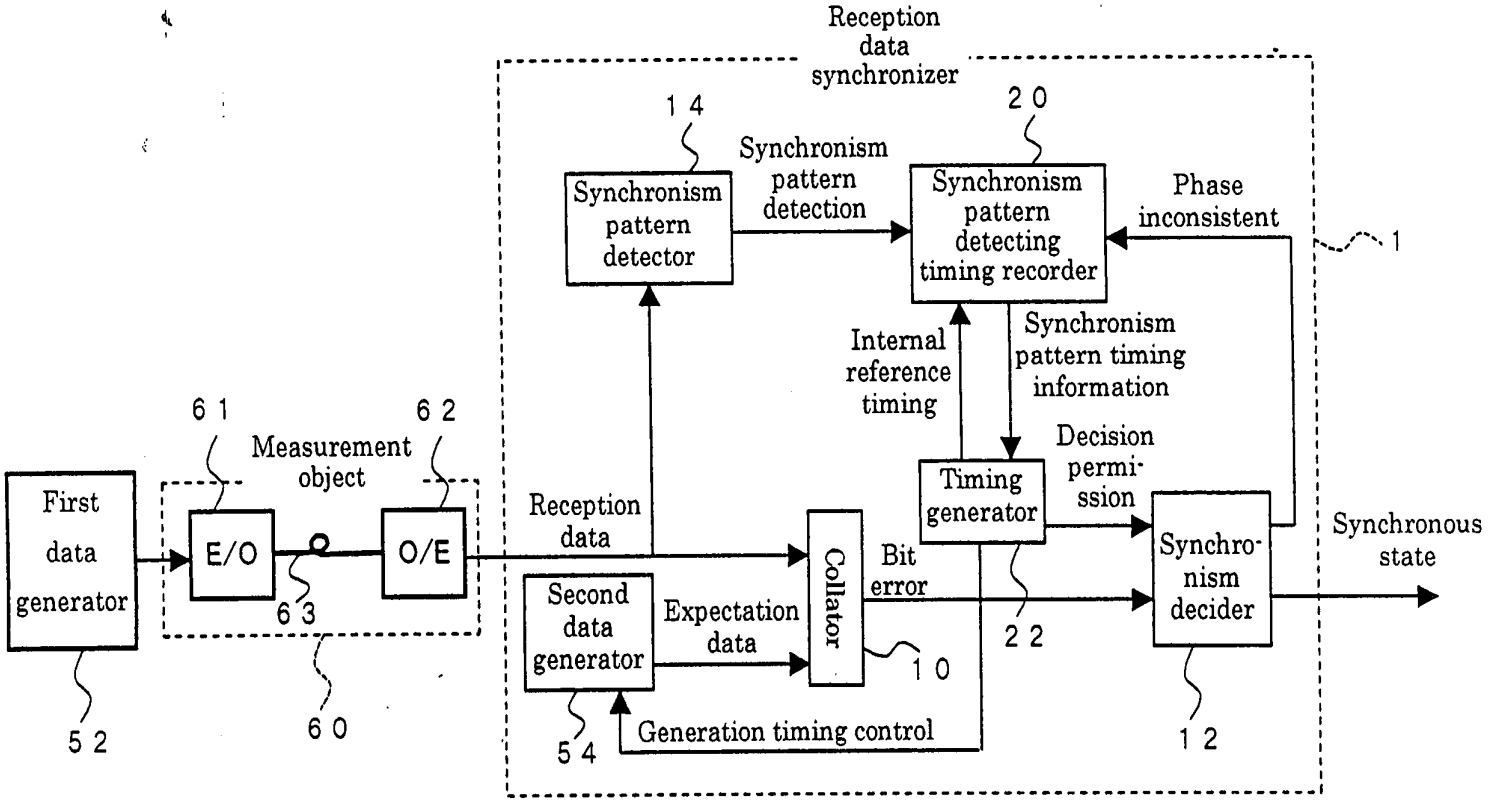
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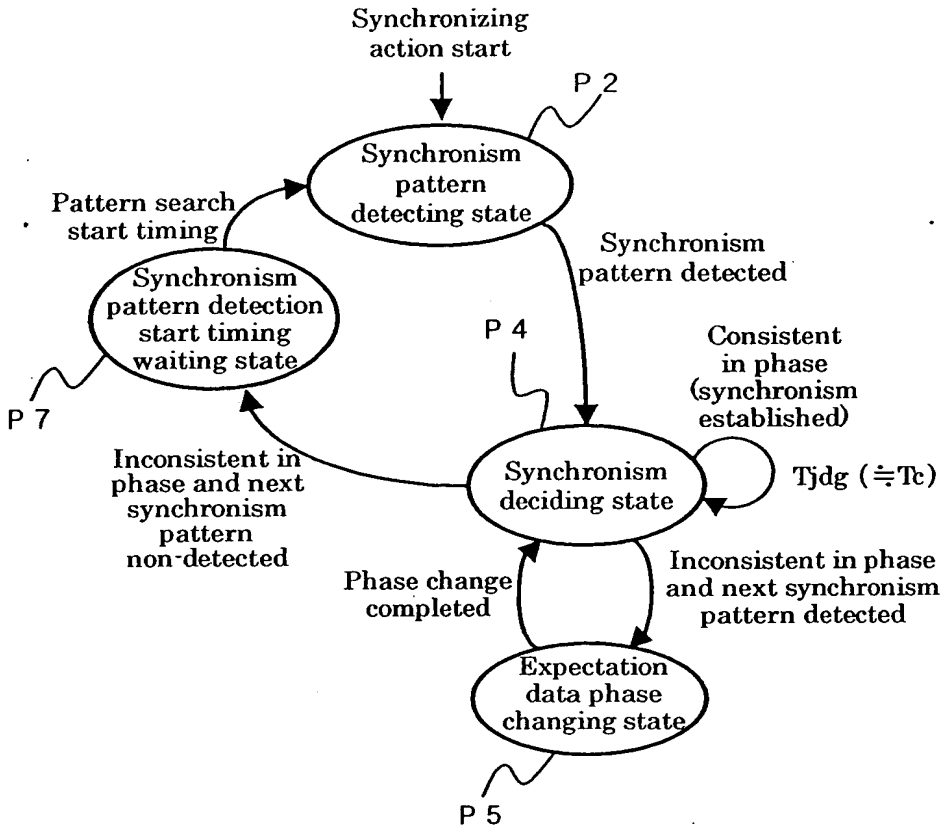
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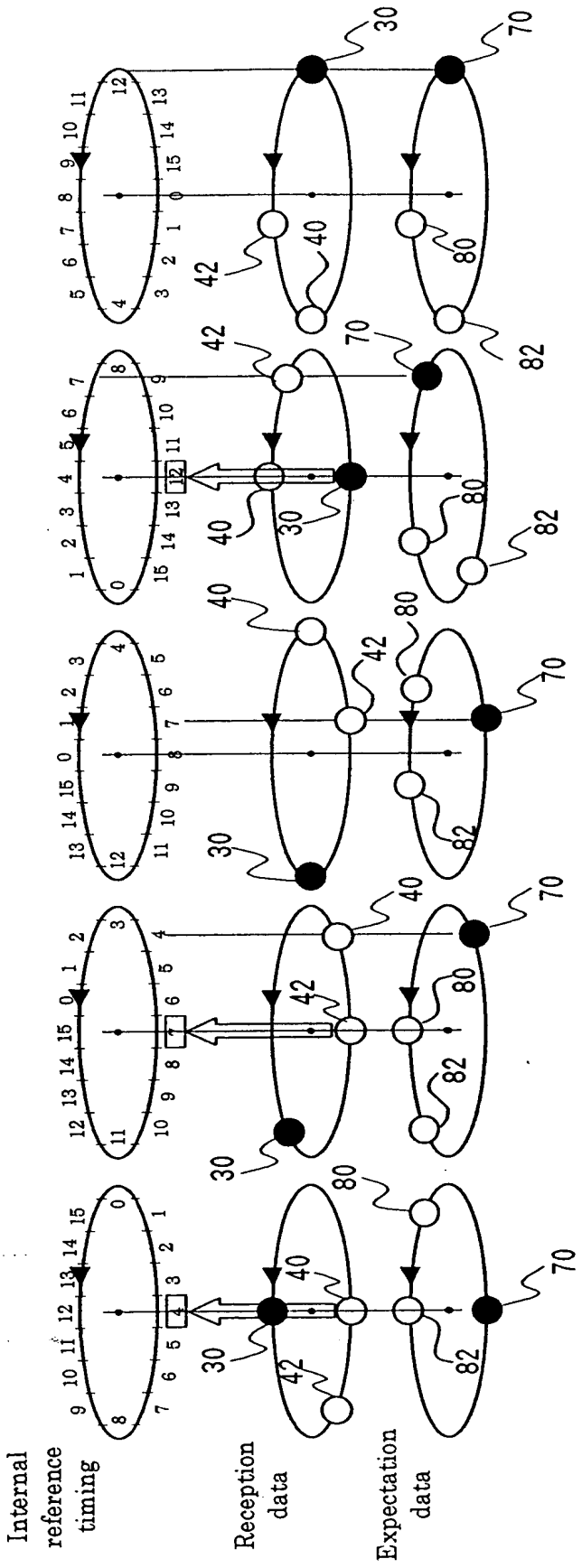
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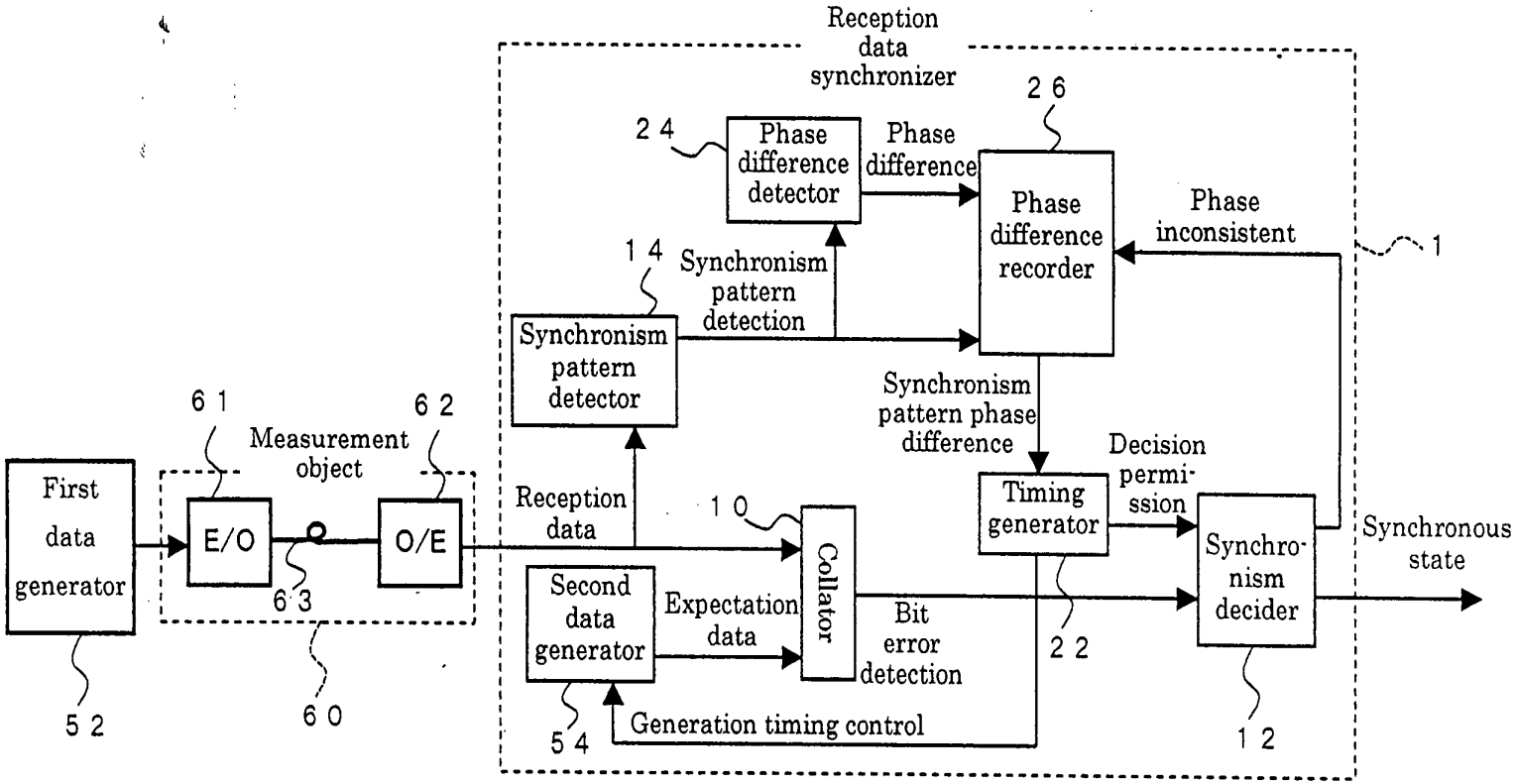


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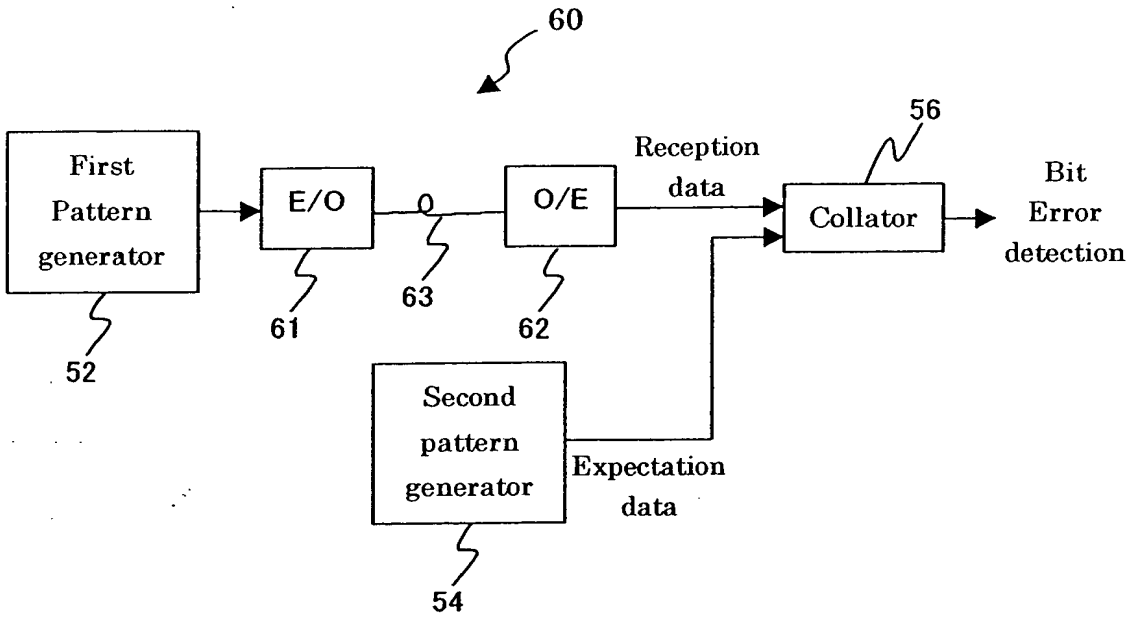


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RECEPTION DATA SYNCHRONIZING APPARATUS AND METHOD, AND RECORDING MEDIUM WITH RECORDED RECEPTION DATA SYNCHRONIZING PROGRAM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a measurement of bit errors, and particularly, to acquisition of a synchronization between reception data past a DUT (Device Under Test) and expectation data by detecting synchronism patterns contained in the reception data and the expectation data.

2. Description of the related art

In cases of data communications by optical fibers there occurs a case causing a bit error. It is then necessary to detect the bit error to be corrected. Fig. 8 shows a system arrangement for making a detection of bit error.

A first pattern generator 52 gives electric data to a DUT (device under test as an element to be measured) 60. The DUT 60 has an E/O (electric/optic) converter 61, O/E (optic/electric) converter 62, and an optical fiber 63. The electric data given to the DUT 60 is converted by the E/O converter 61 into light, which is transmitted through the optical fiber 63 and returned by the O/E converter 62 again into electric data. The data output from the DUT 60 is called reception data.

A second pattern generator 54 generates expectation data for collation with the reception data. At a collator 56, the reception data is collated with the expectation data to find part of the reception data inconsistent with the expectation data, if any, as an inconsistent part to be a bit error.

At the collator 56, for collation between the reception data and the

expectation data, there is needed a synchronism to be obtained between the reception data and the expectation data. There is thus detected a synchronism pattern contained in the reception data, and the expectation data is generated in accordance with the detected timing, thereby obtaining a synchronism.

SUMMARY OF THE INVENTION

However, the reception data contains also a false synchronism pattern, which is not a synchronism pattern, but has like data to the synchronism pattern. Or there is a case in which, due to a bit error of the reception data, a pattern different of data from the synchronism pattern is recognized as a synchronism pattern. Such a pattern can also be deemed as a false synchronism pattern. If an erroneous synchronization is resulted from a false synchronism pattern, there is an inconsistency in phase.

It therefore is an object of the present invention to provide a reception data synchronizing apparatus that allows a synchronization to be obtained between reception data and expectation data even with an inconsistency in phase due to a false synchronism pattern.

According to the present invention described in claim 1, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting position recording unit for recording a synchronism timing at which the synchronism pattern of the reception data is detected; a collation and synchronism decision unit for collating the reception data with reference data to decide whether or not the reception data is consistent in

phase with the reference data; and a synchronism control unit operative, when the collation and synchronism decision unit gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording unit and a timing of a synchronism pattern of the expectation data.

In a reception data synchronizing apparatus arranged as above-noted, even with an inconsistency in phase between reception data and reference data, it is after a synchronism timing at which a synchronism pattern when synchronized is detected that a detection of the synchronism pattern restarts to make the reception data and the reference data consistent in phase, thus allowing for the reception data to be synchronized with expectation data even with an inconsistency in phase due to a false synchronism pattern.

According to the present invention described in claim 2, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting timing recording unit for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data; a collation and synchronism decision unit for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating unit operative, when the collation and synchronism decision unit gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording unit, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

In a reception data synchronizing apparatus arranged as above-noted,

even with an inconsistency in phase between reception data and reference data, it is by a match between a next synchronism pattern detecting timing and a timing of a synchronism pattern of expectation data that the reception data and the reference data are made consistent in phase, thus allowing for the reception data to be synchronized with the expectation data even with an inconsistency in phase due to a false synchronism pattern.

Further, the next synchronism pattern detecting timing in record is used to render the reception data and the reference data consistent in phase, without the need of waiting a detection of synchronism pattern, thus allowing for a rapid synchronization to be obtained between the reception data and the expectation data.

The present invention described in claim 3, is a reception data synchronizing apparatus according to claim 2, wherein the timing generating unit transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording unit records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

According to the present invention described in claim 4, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording unit for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected; a collation and synchronism decision unit for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating unit operative, when the collation and synchronism

decision unit gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording unit.

In a reception data synchronizing apparatus arranged as above-noted also, there can be obtained a synchronization between reception data and expectation data even with an inconsistency in phase due to a false synchronism pattern, like the invention of claim 2.

Further, a phase difference in record is used to render the reception data and reference data consistent in phase, without the need of waiting a detection of synchronism pattern, thus allowing for a rapid synchronization to be obtained between the reception data and the expectation data.

According to the present invention described in claim 5, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording unit for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time; a collation and synchronism decision unit for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating unit operative, when the collation and synchronism decision unit gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording unit.

In a reception data synchronizing apparatus arranged as above-noted also,

there can be obtained a synchronization between reception data and expectation data even with an inconsistency in phase due to a false synchronism pattern, like the invention of claim 2.

Further, a phase difference in record is used to render the reception data and the reference data consistent in phase, without the need of waiting a detection of synchronism pattern, thus allowing for a rapid synchronization to be obtained between the reception data and the expectation data.

According to the present invention described in claim 6, a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting position recording step for recording a synchronism timing at which the synchronism pattern of the reception data is detected; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a synchronism control step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording step and a timing of a synchronism pattern of the expectation data.

According to the present invention described in claim 7, a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the

reception data; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

The present invention described in claim 8, a reception data synchronizing method according to claim 7, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

According to the present invention described in claim 9, a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording step.

According to the present invention described in claim 10, a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording step.

According to the present invention described in claim 11, a computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting position recording step for recording a synchronism timing at which the synchronism pattern of the reception data is detected; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a synchronism control step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism

pattern detecting position recording step and a timing of a synchronism pattern of the expectation data.

According to the present invention described in claim 12, a computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

The present invention described in claim 13, a computer-readable medium according to claim 12, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

According to the present invention described in claim 14, a computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the

reception data, includes: a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording step.

According to the present invention described in claim 15, a computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time; a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording step.

According to the present invention described in claim 16, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting position recording device that records a synchronism timing at which the synchronism pattern of the reception data is detected; a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a synchronism control device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording device and a timing of a synchronism pattern of the expectation data.

According to the present invention described in claim 17, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a synchronism pattern detecting timing recording device that records a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data; a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording device, as a subsequent one, and a timing of a synchronism pattern of

the expectation data.

The present invention described in claim 18, is a reception data synchronizing apparatus according to claim 2, wherein the timing generating device transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording device records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

According to the present invention described in claim 19, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording device that records a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected; a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording device.

According to the present invention described in claim 20, a reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, includes: a phase difference recording device that records a time difference between a synchronism

pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time; a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording device.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the arrangement of a reception data synchronizer according to a first embodiment of the invention;

Fig. 2 is a status transition diagram showing actions of the first embodiment;

Fig. 3 is a diagram showing an example of obtaining a synchronization between reception data and expectation data of the first embodiment;

Fig. 4 is a block diagram showing the arrangement of a reception data synchronizer according to a second embodiment of the invention;

Fig. 5 is a status transition diagram showing actions of the second embodiment;

Fig. 6 is a diagram showing an example of obtaining a synchronization between reception data and expectation data of the second embodiment;

Fig. 7 is a block diagram showing the arrangement of a reception data synchronizer according to a third embodiment of the invention; and

Fig. 8 is a block diagram showing a system arrangement for performing a bit error detection in the prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

There will be described below a first embodiment of the invention with reference to the drawings. First, there is described the arrangement of a reception data synchronizer according to a first embodiment. Fig. 1 is a block diagram showing the arrangement of the reception data synchronizer according to the first embodiment.

The reception data synchronizer 1 includes a collator 10, a synchronism decider 12, a synchronism pattern detector 14, a synchronism controller 16, a synchronism pattern detecting position recorder 18, and a second data generator 54.

The collator 10 performs a collation between input reception data and expectation data, detecting a different data between the two data, bit by bit, that is, for a detection of bit error.

The reception data input to the collator 10 is output from a first pattern generator 52 via a DUT 60. The DUT 60 includes an E/O (electric/optical) converter 61, an O/E (optical/electric) converter 62, and an optical fiber 63. At both ends of the optical fiber 63 are connected the E/O converter 61 and the O/E converter 62. To the E/O converter 61 is connected the first pattern generator 52, and to the O/E converter 62, the collator 10. The expectation data input to the collator 10 is input from the second data generator 54.

The synchronism decider 12 decides whether or not the reception data and

the expectation data have consistent phases, that is, if they are in synchronism. The decision for synchronism is made for a synchronism to be decided if bit errors detected at the collator 10 are under a predetermined amount. If they are out of synchronism, their phases are inconsistent, causing a great amount of different data. Thus, a consistency in phase can be decided by this method. The synchronism decider 12, when deciding phases to be inconsistent, transmits the effect to a synchronism controller 16 and a synchronism pattern detecting position recorder 18 to be described later.

The synchronism pattern detector 14 is adapted, in a state of the later-described synchronism pattern detecting position recorder 18 providing a permission for a detection of synchronism pattern, for detecting a synchronism pattern from the reception data to notify information of the detection timing to the later-described synchronism controller 16 and the synchronism pattern detecting position recorder 18.

The synchronism controller 16 is adapted, when notified of a synchronism pattern detection from the synchronism pattern detector 14, to release the second data generator 54 from a reset state and, at a timing at which a position of the detected synchronism pattern and a position of a synchronism pattern of the expectation data are consistent, to have the second data generator 54 generate the expectation data, permitting the synchronism decider 12 to make a decision of synchronism. It is further adapted, upon reception of a phase inconsistency from the synchronism decider 12, to reset the second data generator 54, initializing the second data generator 54 so that the expectation data stops at a predetermined phase until the resetting becomes released.

The synchronism pattern detecting position recorder 18 records a timing (position) where the synchronism pattern of the reception data is detected. Further, upon reception of a notification of phase inconsistency from the

synchronism decider 12, it permits the synchronism pattern detector 14 to detect a synchronism pattern from a position next to the position in the reception data at which the synchronism pattern is detected.

Next, there are described actions of the first embodiment by using a status transition diagram of Fig. 2. Ts0, Tc, and Tw0 are necessary times for P2, P4, and P6, respectively. From the first pattern generator 52 is input reception data, via the DUT 60, to the synchronism pattern detector 14. At the synchronism pattern detector 14, there is detected a synchronism pattern in the reception data (P2).

The synchronism pattern detector 14 having detected the synchronism pattern in the reception data notifies the synchronism controller 16 and the synchronism pattern detecting position recorder 18 of information on a timing of the detection (P2 → P4). Then, the synchronism controller 16 gives a permission for a decision of synchronism to the synchronism decider 12 (P2 → P4).

The synchronism detector 12 decides, depending on an amount of bit errors output from the collator 10, whether the reception data and the expectation data are in synchronism (P4). If they are in synchronism, the decision of synchronism is continued to be made on the basis of a bit error amount (P4 → P4).

If they are inconsistent in phase (synchronism disorder), the synchronism controller 16 resets the second data generator 54 to interrupt transmission of the expectation data (P4 → P6). Then, the detection of synchronism pattern at the synchronism pattern detector 14 is stopped up to a position of synchronism pattern recorded in the synchronism pattern detecting position recorder 18 (P6).

Upon arrival to the position of synchronism pattern recorded in the synchronism pattern detecting position recorder 18, the synchronism pattern

detecting position recorder 18 gives a permission for a detection of synchronism pattern to the synchronism pattern detector 14 (P6 → P2), and the synchronism pattern detector 14 detects the synchronism pattern in the reception data (P2). Then, if the synchronism pattern is detected, the control flow goes to the synchronism deciding state (P4). Like this, even in the case of a failed synchronism due to a false synchronism pattern, the synchronization can be redone.

Fig. 3 is an example of reception data and the like. Using Fig. 3, an exemplary procedure is described to show how to obtain a synchronization. The reception data has a synchronism pattern 30 and a false synchronism pattern 32. The expectation data also has a synchronism pattern 70 and a false synchronism pattern 72. The synchronism pattern detecting position recorder 18 has an internal reference timing of an identical period to the reception data and the expectation data. If the false synchronism pattern 32 of the reception data is first mistaken as a synchronism pattern at a position of an internal reference timing 4, the timing is recorded in the synchronism pattern detecting position recorder 18 and occurrence of the expectation data starts, causing a transition from the synchronism pattern detecting state to a synchronism deciding state (P2 → P4). The synchronism pattern detected from the reception data is the false synchronism pattern 32, which is different from the true synchronism pattern 30, and hence is decided to be inconsistent in phase at the synchronism decider 12, causing a transition from the synchronism deciding state to a synchronism pattern detection start timing waiting state (P6), where the second data generator 54 is initialized. Next, following an interruption of synchronism pattern detection up to the synchronism pattern detecting timing (internal reference timing 4) recorded in the synchronism pattern detecting position recorder 18, there occurs a transition from the synchronism pattern detection start timing

waiting state to a synchronism pattern detecting state (P6 → P2). Thereafter, the true synchronism pattern 30 is detected at a position of an internal reference timing 0, causing a transition from the synchronism pattern detecting state to a synchronism deciding state (P2 → P4), where a decision for a phase consistency is given at the synchronism decider 12, with an established synchronism.

It is now assumed that Tw0 is a time interval from the time when it is failed to obtain a synchronism to a start time of a detection of synchronism pattern, Ts0 is a time interval from the start time of the detection of synchronism pattern to a time when a synchronism pattern is detected, and Tc is a time interval for deciding whether or not a synchronism pattern of reception data and a synchronism pattern of expectation data are identical in phase.

Then, an average sync gain time Tsync0 is about 0.5 Np x (Tw0 in average + Ts0 in average + Tc in average), where Np is the number of synchronism patterns detected within one period.

According to the first embodiment, even with an inconsistency in phase due to a false synchronism pattern, the synchronism pattern detecting position recorder 18 allows for the synchronism pattern detector 14 to redo a detection of synchronism pattern from a timing (position) where a previous synchronism is obtained, so that a synchronism can be obtained between reception data and expectation data even with a phase inconsistency.

Second Embodiment

There will be described below a second embodiment of the invention with reference to the drawings. The second embodiment is different in that a timing (position) at which a synchronism pattern in reception data is detected is recorded in a synchronism pattern detecting timing recorder 20, and is used for a synchronization to be redone.

First, there is described the arrangement of a reception data synchronizer according to the second embodiment. Like parts to the first embodiment are designated by like reference characters, omitting their description. Fig. 4 is a block diagram showing the arrangement of the reception data synchronizer according to the second embodiment. Like parts to the first embodiment are designated by like reference numerals, omitting their description.

The reception data synchronizer 1 includes a collator 10, a synchronism decider 12, a synchronism pattern detector 14, the synchronism pattern detecting timing recorder 20, a timing generator 22, and a second data generator 54.

The synchronism decider 12, when deciding phases to be inconsistent, transmits the effect to the synchronism pattern detecting timing recorder 20 to be described later.

The synchronism pattern detector 14 detects a synchronism pattern from reception data, and makes a notification of the effect to the synchronism pattern detecting timing recorder 20 to be described later.

The synchronism pattern detecting timing recorder 20 is notified of a detection of the synchronism pattern from the synchronism pattern detector 14. Then, it receives an internal reference timing of the reception data synchronizer 1, from the timing generator 22 to be described later. Then, it records the internal reference timing at the time when the synchronism pattern is detected. Further, upon reception of a notification of phase inconsistency from the synchronism decider 12, it transmits the internal reference timing at the time when the synchronism pattern is detected, to the timing generator 22.

Upon reception of the internal reference timing at the time when the synchronism pattern is detected, the timing generator 22 gives a permission for synchronism decision to the synchronism decider 12. Moreover, it makes the second data generator 54 transmit therefrom expectation data so that a position of

a synchronism pattern of the expectation data coincides with a position of the detected synchronism pattern. Further, it sends a predetermined reference timing signal (called an internal reference timing) to the synchronism pattern detecting timing recorder 20.

Next, there are described actions of the second embodiment by using a status transition diagram of Fig. 5. Tjdg is a required time at P4, while the Tjdg is substantially equal to Tc.

From the first pattern generator 52 is input reception data, via a DUT 60, to the synchronism pattern detector 14. At the synchronism pattern detector 14, there is detected a synchronism pattern in the reception data (P2).

The synchronism pattern detector 14 having detected the synchronism pattern in the reception data notifies the synchronism pattern detecting timing recorder 20 of the effect and a position of the synchronism pattern in the reception data. The synchronism pattern detecting timing recorder 20, receiving those, outputs to the timing generator 22 a signal (as synchronism pattern timing information) indicating a timing of detection of the synchronism pattern (P2 → P4). Then, the timing generator 22 responds to the synchronism pattern timing information by controlling the second data generator 54 so that the position of the detected synchronism pattern of the reception data and the position of the synchronism pattern of the expectation data coincide with each other, and by giving a permission for a decision of synchronism to the synchronism decider 12 (P2 → P4).

The synchronism detector 12 decides, depending on an amount of bit errors output from the collator 10, whether the reception data and the expectation data are in synchronism (P4). If they are in synchronism, the decision of synchronism is continued to be made on the basis of a bit error amount (P4 → P4).

If they are inconsistent in phase (synchronism disorder), there is taken one of different processes depending on whether a subsequent synchronism pattern has already been detected or not. If an internal reference timing at the time when the synchronism pattern was detected has already been recorded in the synchronism pattern detecting timing recorder 20 (P4 → P5), the timing generator 22 controls the second data generator 54 so that the synchronism pattern of the expectation data is matched with the internal reference timing at the time when the synchronism pattern was detected (P5). Then, when the matching of the synchronism pattern of the expectation data is finished (P5 → P4), the control flow returns to the decision on whether or not synchronized (P4).

Unless an internal reference timing at the time when the synchronism pattern was detected has already been recorded in the synchronism pattern detecting timing recorder 20 (P4 → P7), there is kept a waiting (P7) until an internal reference timing at the time when the synchronism pattern is detected is recorded in the synchronism pattern detecting timing recorder 20. Then, the synchronism pattern detecting timing recorder 20 sends an internal reference timing at the time when the synchronism pattern is detected to the timing generator 22, and there is made a decision of synchronism (P7 → P2 → P4).

Upon arrival to a position of synchronism pattern recorded last time, the synchronism pattern detecting timing recorder 20 restarts recording a detection timing of synchronism pattern (P6 → P2). Then, if a synchronism pattern is detected, the control flow goes to a synchronism deciding state (P4). Like this, even in the case of a failed synchronism due to a false synchronism pattern, the synchronization can be redone.

Fig.6 is an example of reception data and the like. Using Fig. 6, an exemplary procedure is described to show how to obtain a synchronization. The reception data has a synchronism pattern 30 and false synchronism patterns 40,

42. The expectation data also has a synchronism pattern 70 and false synchronism patterns 80, 82.

First, if the false synchronism pattern 40 is mistaken as the synchronism pattern 30 by the synchronism pattern detector 14 (P2 → P4), the timing generator 22 controls the second data generator 54 so that the synchronism pattern 70 of the expectation data is matched with a timing (position) 4 of the false synchronism pattern 40, to transmit the expectation data. Then, there is made a decision of synchronism between the reception data and the expectation data (P4), Fig. 6(a).

As a result, with no synchronism obtained, phases are inconsistent. However, as a timing (position) 7 of the false synchronism pattern 42 is recorded in the synchronism pattern detecting timing recorder 20 (P4 → P5), Fig. 6(b), the timing generator 22 controls the second data generator 54 so that the synchronism pattern 70 of the expectation data is matched with the timing (position) 7 of the false synchronism pattern 42, to transmit the expectation data. Then, there is made a decision of synchronism between the reception data and the expectation data (P4), Fig. 6(c).

As a result, with no synchronism obtained, phases are inconsistent. However, as a timing (position) 12 of the synchronism pattern 30 is recorded in the synchronism pattern detecting timing recorder 20 (P4 → P5), Fig. 6(d), the timing generator 22 controls the second data generator 54 so that the synchronism pattern 70 of the expectation data is matched with the timing (position) 12 of the synchronism pattern 30, to transmit the expectation data. Then, there is made a decision of synchronism between the reception data and the expectation data (P4), Fig. 6(e).

Now, with a synchronism obtained, there is continuously made a decision of synchronism (P4 → P4).

According to the second embodiment, even with false synchronism patterns, the second data generator 54 can generate expectation data for a synchronization to be redone, in accordance with a timing when a synchronism pattern recorded in the synchronism pattern detecting timing recorder 20 is detected, so that a synchronism can be obtained between reception data and expectation data.

Further, in the second embodiment, a sync gain time is (an average required time for a single decision of phase consistency) x Np at the longest, or 0 at the shortest, and an average sync gain time is (the average required time for a single decision of phase consistency) x Np/2. The average required time for a single decision of phase consistency is substantially equal to an average of Tc, and can be shortened by 0.5Np x (Tw0 in average + Ts0 in average) in comparison with the first embodiment. Thus, the average sync gain time can be rendered small. Therefore, bit errors can be detected in a short bit sequence such as a burst data.

For example, assuming a case of data having a pattern length of 1M bits, a data rate of 100 Mbps, and an Np of 10, then Tw0 is 0 at the shortest or identical in time to one period of data at the longest. Therefor, an average Tw0 is (one period of data) / 2. An average Ts0 is (one period of data) / (2 * Np) (Ts0 to be 0 at the shortest or one period of data / Np at the longest). Therefore, in the first embodiment, Tw0 in average = (1M / 100M) / 2 = 0.005 [s] = 5 [ms], Ts0 in average = (1M / 100M) / (2 x 10) = 0.0005 [s] = 0.5 [ms], and Tc in average = 1 [ms]. Therefore, the average sync gain time = (10 / 2) x (5 + 0.5 + 1) = 32.5 [ms]. On the other hand, in the second embodiment, the average sync gain time = (10 / 2) x Tc = 5 [ms]. As will be seen from this example, the average sync gain time in the second embodiment is shorter than the average sync gain time in the first embodiment.

Third Embodiment

There will be described below a third embodiment of the invention with reference to the drawings. In comparison with the second embodiment using the synchronism pattern detecting timing recorder 20, the third embodiment is different in that it uses a phase difference recorder 26 for recording a phase difference between a detected synchronism pattern and an initially detected synchronism pattern or a phase difference between a detected synchronism pattern and a synchronism pattern detected in a previous time.

First, there is described the arrangement of a reception data synchronizer according to the third embodiment. Like parts to the first embodiment are designated by like reference characters, omitting their description. Fig. 7 is a block diagram showing the arrangement of the reception data synchronizer according to the third embodiment. Like elements to the first embodiment are designated by like reference numerals, omitting their description.

The reception data synchronizer 1 includes a collator 10, a synchronism decider 12, a synchronism pattern detector 14, a timing generator 22, a phase difference detector 24, the phase difference recorder 26, and a second data generator 54.

The phase difference detector 24, having received a notification of a detected synchronism pattern from the synchronism pattern detector 16, detects a phase difference between the detected synchronism pattern and an initially detected synchronism pattern or a phase difference between the detected synchronism pattern and a synchronism pattern detected in a previous time, and sends it to the phase difference recorder 26 to be described later. The phase difference recorder 26 records the phase difference detected by the phase difference detector 24.

Actions of the third embodiment are analogous to the second embodiment, but for the difference that a phase difference is used. The phase difference is used for changing phases of expectation data (P5, see Fig. 5). As a description using an example of Fig. 6, in the second embodiment, the synchronism pattern 70 of the expectation data is matched with the internal reference timings 4, 7, and 12, one by one in this order.

In the third embodiment, there are recorded in the phase difference recorder 26 a timing 4 at which a synchronism pattern is initially detected, a difference 3 (7-4) between a timing at which the synchronism pattern is detected twice and the timing at which the synchronism pattern is initially detected, and a difference 8 (12-4) between a timing at which the synchronism pattern is detected thrice and the timing at which the synchronism pattern is initially detected, and unless a synchronism is obtained at the timing 4, the timing of the synchronism pattern 70 is shifted by 3 to make a decision of synchronism at a resultant timing, and unless a synchronism is then obtained, the timing of the synchronism pattern 70 is shifted by 8 from the initial to make a decision of synchronism at a resultant timing.

Or, in the third embodiment, there are recorded in the phase difference recorder 26 the timing 4 at which the synchronism pattern is initially detected, the difference 3 (7-4) between the timing at which the synchronism pattern is detected twice and the timing at which the synchronism pattern is initially detected, and a difference 5 (12-7) between the timing at which the synchronism pattern is detected thrice and the timing at which the synchronism pattern is detected twice, and unless a synchronism is obtained at the timing 4, the timing of the synchronism pattern 70 is shifted by 3 to make a decision of synchronism at a resultant timing, and unless a synchronism is then obtained, the timing of the synchronism pattern 70 is further shifted by 5 to make a decision of synchronism

at a resultant timing.

Like effects to the second embodiment can be achieved by the third embodiment also.

According to the present invention, there can be obtained a synchronization between reception data and expectation data even with an inconsistency in phase due to a false synchronism pattern.

WHAT IS CLAIMED IS:

1. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting position recording means for recording a synchronism timing at which the synchronism pattern of the reception data is detected;

a collation and synchronism decision means for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a synchronism control means operative, when the collation and synchronism decision means gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording means and a timing of a synchronism pattern of the expectation data.

2. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording means for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision means for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating means operative, when the collation and synchronism decision means gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording means, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

3. A reception data synchronizing apparatus according to claim 2, wherein the timing generating means transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording means records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

4. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording means for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected;

a collation and synchronism decision means for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating means operative, when the collation and synchronism decision means gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the

synchronism pattern detecting timing recording means.

5. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording means for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time;

a collation and synchronism decision means for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating means operative, when the collation and synchronism decision means gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording means.

6. A reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting position recording step for recording a synchronism timing at which the synchronism pattern of the reception data is detected;

a collation and synchronism decision step for collating the reception data

with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a synchronism control step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording step and a timing of a synchronism pattern of the expectation data.

7. A reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

8. A reception data synchronizing method according to claim 7, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference

timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

9. A reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording step.

10. A reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a

previous one at which the synchronism pattern is detected in a previous time;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording step.

11. A computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting position recording step for recording a synchronism timing at which the synchronism pattern of the reception data is detected;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a synchronism control step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording step and a timing of a synchronism pattern of the expectation data.

12. A computer-readable medium embodying a program of instructions for

execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording step for recording a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording step, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

13. A computer-readable medium according to claim 12, wherein the timing generating step transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording step records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

14. A computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording step.

15. A computer-readable medium embodying a program of instructions for execution by the computer to perform a reception data synchronizing method for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording step for recording a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time;

a collation and synchronism decision step for collating the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating step operative, when the collation and synchronism decision step gives a decision for inconsistency in phase, for shifting a

synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording step.

16. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting position recording device that records a synchronism timing at which the synchronism pattern of the reception data is detected;

a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a synchronism control device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for a match between a timing at which the synchronism pattern is detected after the synchronism timing recorded in the synchronism pattern detecting position recording device and a timing of a synchronism pattern of the expectation data.

17. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a synchronism pattern detecting timing recording device that records a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data;

a collation and synchronism decision device that collates the reception

data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recording device, as a subsequent one, and a timing of a synchronism pattern of the expectation data.

18. A reception data synchronizing apparatus according to claim 2, wherein the timing generating device transmits a predetermined reference timing signal, and the synchronism pattern detecting timing recording device records the reference timing signal when the synchronism pattern is detected, as the synchronism pattern detecting timing.

19. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording device that records a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as an initial one at which the synchronism pattern is initially detected; .

a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for shifting a

synchronism timing of the expectation data from the synchronism pattern detecting timing, as the initial one, by the time difference recorded in the synchronism pattern detecting timing recording device.

20. A reception data synchronizing apparatus for a synchronization to be obtained between reception data having a synchronism pattern for a synchronism to be obtained and expectation data as an expected value of the reception data, comprising:

a phase difference recording device that records a time difference between a synchronism pattern detecting timing at which the synchronism pattern is detected in the reception data and the synchronism pattern detecting timing, as a previous one at which the synchronism pattern is detected in a previous time;

a collation and synchronism decision device that collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data; and

a timing generating device operative, when the collation and synchronism decision device gives a decision for inconsistency in phase, for shifting a synchronism timing of the expectation data by the time difference recorded in the synchronism pattern detecting timing recording device.

ABSTRACT OF THE DISCLOSURE

A synchronism pattern detecting timing recorder (20) records a synchronism pattern detecting timing at which a synchronism pattern is detected in reception data, a synchronism decider (12) collates the reception data with reference data to decide whether or not the reception data is consistent in phase with the reference data, and a timing generator (22) operates, when the synchronism decider (12) gives a decision for inconsistency in phase, for a match between the synchronism pattern detecting timing recorded in the synchronism pattern detecting timing recorder (20), as a subsequent one, and a timing of a synchronism pattern of the expectation data, and the subsequent synchronism pattern detecting timing in record is used to render the phases consistent, allowing for a rapid synchronization to be obtained, without the need of waiting a detection of synchronism pattern, even with an inconsistency in phase due to a false synchronism pattern.

Figure 4